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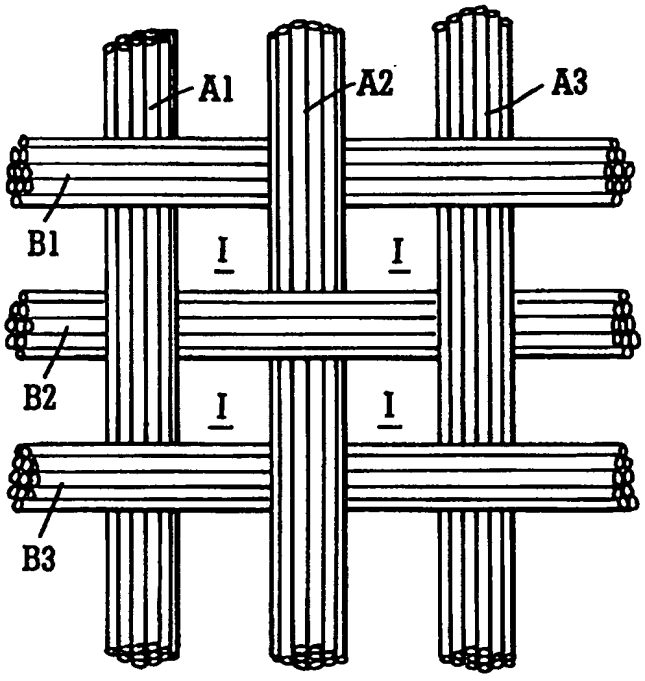
(54) Title: PROTECTIVE MATERIAL

(57) Abstract

A protective material suitable for use as body armour, able to withstand penetration by a pointed weapon such as a dagger, is made from twisted multi-strand cable woven into a lattice having interstices, each cable comprising strands grouped in sets; the strands of the sets and the sets of the cable being twisted in opposite directions.



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PROTECTIVE MATERIAL

The invention relates to protective material useful as body armour of the sort to be worn for security purposes. More particularly it is an object of the invention to provide body armour material which can withstand attack by a sharp weapon such as a dagger and resist other forms of assault.

In one aspect the invention provides a stab-resistant flexible lightweight mesh comprising lengths of multi-strand cable woven together into a lattice having interstices, each length overlying the length substantially at right angles to it, the lengths being spaced such that they co-operate to resist movement apart when the tip of a stab weapon is urged into the interstice, whereby the interstice tends to maintain its integrity.

Because of the structure of the wires, the network or mesh is relatively flexible. The reverse twist of sets within a wire, provides strength and flexibility. Preferably the network is dimensioned so that the wires are close together so that the interstices in between are small. As a result of the woven nature of the wires an attempt to insert a knife through the network will fail. An attempt to cut the mesh will be resisted by the flexibility of the wires. The force of a direct blow will be deflected leaving little or no trauma damage.

Preferably the network or mesh is a relatively open weave say 14 meshes per linear inch or 12 meshes per linear inch. The number of strands making up each wire may vary widely according to need.

Preferably the strands are formed of high tensile carbon steel or stainless steel, optionally plated for example brass plated.

The network or mesh may be arranged so that one layer will suffice, preferably two layers are present one above the other to ensure that a jacket or the like made of the material is impregnable.

Material of the invention may be used for a variety of uses for example in body vests, protection panels for groin, arm or leg and the like; fencing; as curtains or shields on vehicles; as anti-mine protection for boots; and the like. The material may be joined, e.g. stitched to one or more layers of cotton, KEVLAR and the like, to form a unitary material.

In order that the invention may be well understood it will now be described by way of example with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a plan view of woven mesh of the invention;

Figure 2 is a side elevation partly in section of one interstice drawn to an enlarged scale; and

Figure 3 shows the detail of an individual wire.

The mesh is made up of woven lengths of wire, each made up of strands and according to Figure 3. The wires are arranged in a lattice, having warps A1,A2,A3 .... An, and wefts B1,B2,B3 ....Bn., defining interstices I of generally square shape.

Because of the weaving the mesh is not rectilinear as seen in elevation, but one wire bends over the other, i.e. as shown in Figure 2, the wire B1 bends over wire A1 and under wire A2. As a result the side walls of each interstice I have an upward ramp portion.

Each wire is made of sets of strands S1,S2,S3 ....Sn, of high tensile material such as a carbon steel or stainless steel. As shown in Figure 3, each set comprises three strands wound or twisted together in a helix in one direction using ordinary lay (also called reverse lay) pattern; i.e. the three sets are wound together in the opposite direction. The number of sets and the number of strands in each set may be varied according to need.

When the blade K of a knife is urged towards the vest, in say a stabbing action, the tip of the blade will be urged into an interstice I. As the blade moves forward it will try to urge the walls of the interstice apart. Because the warps and wefts are interwoven, each side

length of an interstice must ride up the ramp of the length at right angles to it; this resistance increases as the blade penetrates (or tries to penetrate) deeper into the vest. As a result the lattice maintains its integrity even though the interstice may increase slightly in cross-sectional area. The nature of the strands tends to blunt the blade, (to the extent that, in tests, resharpening is necessary). Depending on the materials chosen the article may also be bullet proof.

The mesh may be used to make jackets and other protection for police, security guards and persons who may be engaged in armed combat, dog handlers; for body wear for example in sports play as in ball and bat games and diving; work where knives are used, e.g. cutting of meat; in transport as in jackets for motorcyclists; vehicle panels; fencing and like security devices and structures.

CLAIMS

1. A stab-resistant flexible lightweight mesh comprising lengths of multi-strand cable woven together into a lattice having interstices, each length overlying the length substantially at right angles to it, the lengths being spaced such that they co-operate to resist movement apart when the tip of a stab weapon is urged into the interstice, whereby the interstice tends to maintain its integrity.

2. A mesh according to Claim 1, wherein the cable comprises strands arranged in sets, the sets being twisted together.

3. A mesh according to Claim 2, wherein the strands making up each set are twisted together in a hand opposite to that by which the sets are twisted together.

4. Fencing comprising a mesh according to any of Claims 1 to 3.

5. A curtain or shield or panel for a vehicle comprising a mesh according to any of Claims 1 to 3.

6. Stab resistant covering incorporating a layer of mesh according to Claims 1 to 3.

7. A covering according to Claim 6, comprising an article for body protection

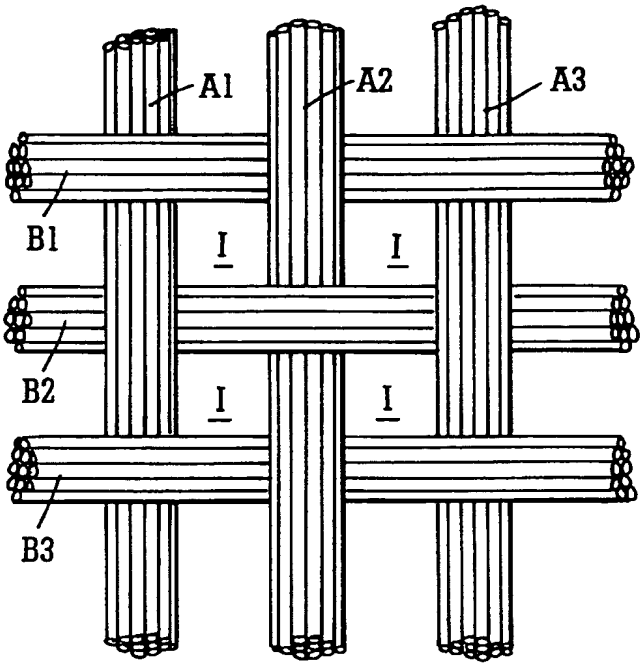

FIG. 1

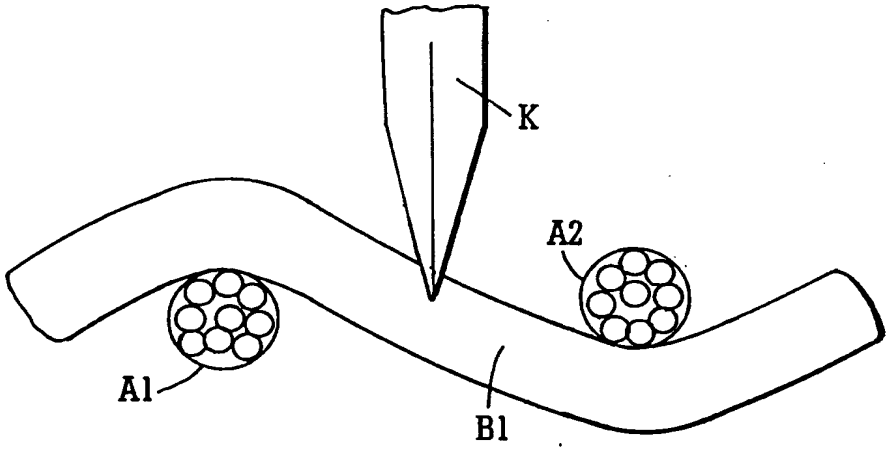

FIG. 2

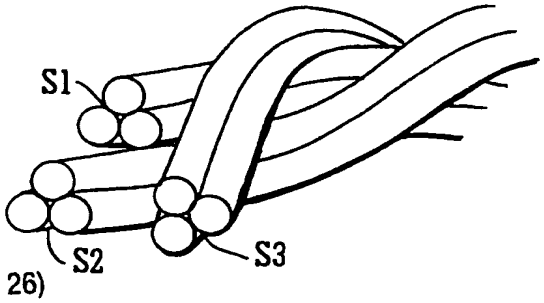

FIG. 3

INTERNATIONAL SEARCH REPORT

Inte .onal Application No
PCT/GB 98/01028

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D03D9/00 A41D31/00 F41H5/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D03D A41D F41H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 97 27769 A (BEKAERT) 7 August 1997 see the whole document	1-7
A	DE 31 01 003 A (REUTLINGER) 29 July 1982 see the whole document	1,2,4,5
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☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

information on patent family members

Inte ional Application No
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